6G4SOCIETY

The relationship between values and technology

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The project

6G4Society (grant agreement ID: 101139070) is an SNS JU project which aims to develop a value-based, sustainable, and ethics-driven approach to 6G technology, ensuring that future networks align with societal needs and expectations. The project aims at providing and fostering a multidisciplinary and complementary perspective to future technological development, applying methodologies from ethics, legal and social sciences and humanities, to to promote inclusive technological development and integrate social values into innovation processes. Also, by engaging key stakeholders—including policymakers, industry leaders, researchers, and the public—6G4Society seeks to ensure correct and clear information about the expected impacts of 6G technology.

6G4Society Insight Reports

The present document is part of a series of thematically focused digests based on key contents, findings and analyses reported in _Deliverable 1.1, Societal Aspects in 6G Technology: Concerns, Acceptance Models and Sustainability Indicators_ (DOI 10.5281/zenodo.14592217). Original contents of this deliverable have been recombined and slightly modified for a more agile and accessible reading experience. This source forms the foundation of the current document and is acknowledged here as the primary reference for uncited content.

6G4Society Insight Report #1: The Relationship between Values and Technology

Understanding the role of values in technology is essential to this mission. Values shape how technologies are conceived, designed, and adopted, influencing their societal impact. This text explores the complex relationship between values and technology, examining how social, cultural, economic, and ethical considerations affect innovation. It provides a structured perspective on how values enter technology and, in turn, how technology reshapes societal values. These reflections align with the project's commitment to fostering responsible innovation in 6G development.

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INTRODUCTION

The relationship between technology and society is dynamic and reciprocal. Technology shapes society by introducing new tools, systems, and modes of interaction, influencing culture, economics, politics, and human behaviour. Society, in turn, shapes the development and application of technology.

'In this dynamic relationship, values play a pivotal role in defining how technology is conceived, designed, and integrated into society. Value systems, norms, and needs guide political and corporate choices toward specific technological development paths, thereby shaping society. Simultaneously, users contribute to this process through their own interpretations and adaptations that emerge from real-world contexts, creating feedback loops that inspire further technological explorations. Understanding how values and technology interact is therefore essential for multiple reasons.

Firstly, it helps to create a clearer awareness about the non-neutral nature of technology. Technologies, as any human artefact, are carriers of cultural values, under the forms of assumptions, biases, ethics trade-offs or compromises. This aspect will be further explored in the paragraph *Values Embedded Implicitly* as well as in *Societal Values: Whose Values?*

Furthermore, developing a clearer understanding of the specific mechanisms through which this interaction unfolds is crucial for guiding technological development in a more deliberate and informed way. This involves identifying key moments within the innovation process where values can be meaningfully and proactively integrated, determining how they can be incorporated at each stage, or—depending on how far the technology has progressed—how they can be monitored and assessed. These aspects are only briefly mentioned here, and will be further explored in the issues that will follow the present work.

Finally, understanding how innovations are created, implemented, and adopted through cultural influences allows us to better consider the wider social implications of technological development across different sectors of society, including education, healthcare, governance, and the economy.

The objective of this discussion is to provide a structured perspective on the process through which values enter technology and subsequently translate into societal impact. The following sections begin with fundamental definitions of value concepts before examining their complex relationship with technological development.

VALUES AND VALUE

Different disciplines interpret "value" in different ways, particularly in the practice of innovation processes and operations, where its meaning can overlap and coexist depending on context [Wikström et al., year]. The term can refer to: (1) a guiding principle or moral driver within a societal or cultural context (e.g., ethics), (2) societal goals and benefits (e.g., Sustainable Development Goals (SDGs), human rights), or (3) worth in economic terms (e.g., value-for-money). Before analyzing the relationship between values and technology, it is important to clarify these different interpretations.

SOCIETAL VALUES: WHAT WE VALUE IN OUR LIVES AND THE WORLD

Sociology and cultural studies define values as abstract concepts, normally associated with what is good in a certain cultural context. These values not only shape the image of ideal or desired futures, but also serve as foundations for human actions and the integration of individuals into communities. They provide individuals with an orientation on how to behave and on how things should be, guiding their decisions, actions, and contributions towards society. Some authors define *values* as "lasting convictions or matters that people feel should be strived for in general, and not just for themselves, to be able to lead a good life or realise a good society[1]".

Besides guiding individuals' actions, values also provide the basis for social decision-making in organised entities, under the form of policy or strategy drivers. Wikström et al.[2] describe these as "values as criteria and goals," shaping judgments on what is good or necessary for societal survival. In innovation, values guide policies, funding decisions, and the selection of use cases, a topic explored further below.

VALUE AS SOCIETAL GOALS AND BENEFITS

Innovation occurs when knowledge is transformed into something that creates impact and value in society, whether economic or social. That is why in the innovation context, the word *value* is often used to refer to *value generation*. Here, *value* signifies the ability to contribute or add something meaningful to the system (value added).

Social or societal value is achieved when an outcome is relevant, useful, and beneficial to society. This could mean improved health, environmental restoration, reduced pollution and inequalities, enhanced skills, stronger social cohesion, or better living conditions. In innovation, this concept of *value* aligns closely with societal goals and is shaped by the *social values* that guide individuals and institutions' actions, choices and behaviours.

Economic value refers to the ability to generate net earnings and competitive advantage (value-for-money). It is typically assessed through economic calculations comparing production costs to revenue. However, economic value also includes factors like quality, convenience, choice, effectiveness, and accessibility. It also encompasses strategic benefits like market expansion, customer acquisition, and identifying novel applications for existing technologies. Cost-benefit analyses typically center on these considerations.

Economic and social value increasingly intersect, with a growing emphasis on shared societal impacts. The OECD, for example, has expanded the notion of value-for-money to include social considerations like human rights, labor standards, non-discrimination, and economic opportunities for marginalised groups. Models such as Responsible Business Conduct (RBC), or certifications such as B Corp, encourage businesses to understand local communities' needs and create Creating Shared Value (CSV).

SOCIETAL VALUES. WHOSE VALUES?

Among the various meanings of value(s) addressed above, the notion of social values most profoundly influences the complex interplay between technology and society. This influence is particularly evident in "digital transformations" - the fundamental changes in social structures,

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[1] L. Royakkers and I. Van de Poel, "Ethics, Technology, and Engineering: an introduction," 2011.

[2] G. Wikström, A. Schuler Scott, I. Mesogiti, R.-A. Stoica, G. Georgiev, S. Barmpounakis, A. Gavras, P. Demestichas, M.-H. Hamon, H.-S. Hallingby and D. Lund, "What societal values will 6G address?," May 2022.

behaviors, and institutions driven by digital technologies. Social values evolve across cultures, over time, and in different contexts. They also vary among social groups and even within individuals, who may prioritize different values depending on their societal roles. This variability demonstrates that social values are, therefore, highly relative concepts rather than universal constants.

The values a society prioritizes are deeply shaped by its cultural history and national context. While there may be broad consensus across Europe on fundamental principles such as safety, freedom, equity, economic security, and health, translating these abstract ideals into concrete policies and actions is complex. The process of operationalizing values—determining what they mean for individuals or specific groups and how they apply to different goals—opens the door to varying interpretations and implementations. Cultural norms, historical experiences, and legal frameworks shape how societies navigate value conflicts and establish priorities. For instance, while security is widely recognized as essential, different societies may weigh it differently against other concerns like privacy, convenience, or innovation, leading to diverse approaches in policy and technology development.

Different social and interest groups may define, prioritize, and enact values in diverse ways, reflecting the inherent relative nature of value systems. Indeed, although values are shared among social groups, they are not evenly distributed across society. What matters to society might not be expressed and prioritised the same way for a specific community or individual, and vice-versa. What matters to one group or person might not matter to another, because   not all groups have the same mainstream needs or reap the same benefits. Even within the same person, value priorities shift over time or across roles—what a professional values may differ from what a parent prioritizes. This is why values informing the level of policy strategies can sometimes collide with individual values.

> *"Whether environmental well-being is considered a luxury or a health threat, can depend on the economic stability of a region: a community whose basic needs are fulfilled will focus on non- economic goals, such as self-expression, quality of life, or quality of air and environment; otherwise all what falls outside of immediate survival (food, shelter, physical security) and necessity could be considered a luxury."*

This variety entails methodological considerations when approaching the concept of *societal values.* For example, interpreting *societal values* by relying solely on individuals (e.g., through user interviews) can lead to misrepresenting societal needs. Understanding social values requires balancing individual and stakeholder insights with broader societal considerations about values, considering diverse contexts, including culture, politics, economics, location, and time.

Values also change over time or during exceptional events. The Coronavirus pandemic affected the prioritization of values within society. Especially in Europe and the US, at the beginning of the pandemic, public and individual health, as well as safety became key priorities, pushing in second order a number of civil rights as well as economic well-being. As the pandemic progressed, discussions around socio-economic sustainability regained centrality.

Differences in value prioritization may generate conflicts. Within the complexity of the societal space, when values are prioritised differently by different interest groups, they may become contested, giving rise to controversies or even conflicts. This is especially the case when values are specified into norms, becoming prescriptions for action and codes for conduct. During the pandemic, debates over confinement measures and mask mandates reflected

different value priorities. Some prioritised public health and safety, while others placed greater emphasis on individual liberties.

Such conflicts acquire relevance in the context of technological development whenever design and implementation choices are capable of reinforcing certain value hierarchies and therefore certain visions of the future over others. At the operative stage, this translates to the need for managing trade-offs between values during development. These aspects will be further explored in future re-elaborations of the same deliverable.

VALUES AND TECHNOLOGIES. AN INTRICATE INTERPLAY

This section will explore how values influence innovation processes and technologies and, conversely, how technology reshapes societal values. This awareness helps guide the direction of technological development, enabling informed decisions that maximize benefits while minimizing harms. Without this awareness, hidden assumptions, cultural biases, and economic interests may drive decisions at the expense of societal well-being.

SOCIETAL VALUES ARE EMBEDDED IN TECHNOLOGY

Values creep into technology in different ways and moments, shaping technology development at every stage throughout the innovation process, from conception to user interaction, including influencing business decisions.

Values operate both explicitly and implicitly. Explicit values are stated as guiding principles in official corporate or institutional documents, which we recognise and endorse. However, values shape technology development also implicitly, under the form of hidden assumptions and biases often going unperceived or unexamined by policy and business managers, developers, or other actors involved in innovation processes.

1. VALUES EXPLICITLY EMBEDDED

Values can also be consciously and proactively embedded into technology in response to explicit institutional requirements or societal demands. For example, the SDGs and the Green Deal advocate for technologies that promote sustainability, equity, justice, and solidarity   . Other examples include values such as accessibility, privacy, security, safety, and transparency. As concerns the 6G industry, ongoing efforts pursue digital inclusivity, energy efficiency, and more in general economic, social and environmental sustainability.

6G research has introduced important innovations to the process of technological development, with leading companies recognising the necessity to expand the design paradigm from mainly performance-oriented to both performance- *and* value-oriented. Considerations regarding social desirability and values important for society have been made more explicit in the description of use-case scenarios and related target applications, marking a positive shift in the way technology shall be conceived.

In practice, efforts are directed toward actively translating these values into design choices, technical requirements measured through Key Performance Indicators (KPIs), and evaluation processes, outlining which nuances of reality we are able to capture and assess. Besides, the ongoing work on Key Value Indicators (KVIs) is aimed at translating and operationalising these abstract values into more concrete, trackable metrics. Value-Sensitive Design (VSD) is a useful method to support such conscious approaches to value. These aspects will be further deepened in future documents.

2. VALUES IMPLICITLY EMBEDDED

Values shape our sense of the common good, influencing priorities, decisions, and actions. Value systems underpin the socio-cultural and normative contexts in which people operate, shaping personal beliefs, biases, expectations and interests, defining a socially shared notion of normal, driving people's daily decisions, and influencing how challenges are perceived, problems framed, and opportunities captured.

The narratives and public imaginary surrounding technology are no exception to this. Research and innovation directions, as any product of human culture, are shaped by socio-technical contexts, made of actors, networks, cultural values, norms, and power dynamics. Each stakeholder and individual enter the process with specific cultures, worldviews and assumptions about what is good, desirable and important, who shall benefit, and how resources shall be managed.

These assumptions often operate unconsciously, taken for granted beneath our awareness. They shape visions, goals, interests, perceived needs, and problem-solving approaches, influencing decisions at various stages of the innovation process, determining:

- what types of technology are envisioned, considered priority and worth pursuing.

- how needs and preferences are identified,

- which key use-cases are selected,

- whose voices are included in the discussion and conception phase,

- what design goals and functionalities are prioritized.

When values and assumptions interact with innovation processes, various biases can emerge and become embedded in technology itself. Insufficient attention to these unconscious values often creates a widening gap between technology's explicit promises and narratives and its actual societal impacts and transformations. This misalignment is a key reason why many technologies fail to adequately address the problems they were designed to solve.

Technology created within a society that values individualism may emphasise features that support personal customisation and autonomy (e.g. remote work capabilities prioritised over equity in access to those capabilities), while a society that values personal attainment may emphasise novel devices over support for a blind person. Diversity in workforce is the best way to counterbalance the risks of biases. [BOX]

3. ASSUMPTIONS AND NARRATIVES SURROUNDING TECHNOLOGIES

The previous sections challenged the assumed neutrality of research and innovation pathways and directions of technological advancement, highlighting their relativity and dependence on cultural assumptions and value systems. Indeed, in research and innovation, values guide policies and industrial strategies long before specific technologies are designed. What core assumptions have fundamentally shaped the development of information and communication technologies (ICT)?

- **Associating innovation to technological advancement.** Innovation –meant as the process through which discoveries and novelties are transposed into societal value– depends primarily on technology advancement.

- **Technological feasibility and innovation breakthroughs often drive economic strategies and investment decisions**, assuming that new applications are both needed and desired by end users. However, this focus on marketability can overshadow real societal needs and limit exploration of possibly more desirable alternatives. As a result, the tendency is to justify the use of existing technologies rather than considering new solutions that align with broader societal aspirations. This constitutes an inherent bias in the shaping of the future and of its technological foundations.
- **Technological advancement is often seen as inherently positive**, with "new" and "more" constituting values in themselves —especially when linked to new features and capabilities connected to values such as speed, automation, virtuality, competitiveness, progress, and efficiency. This is particularly true concerning a number of features underpinning 6G, as for instance:
  - **Hyperconnectivity**. At the global and geopolitical level, a choice has been made that society needs to go towards hyperconnectivity. This has been pursued as an unquestioned goal, driven by the belief that universal connectivity is inherently beneficial. This constitutes a very foundational baseline choice regarding the role of technology within society, and stems from cultural values that emphasise the importance of connection and efficiency, without considering, for example, possible side effects in term of interpersonal interactions and social cohesion.
  - **Artificial Intelligence and automation**: the assumption about artificial intelligence is positive as well as deterministic, for the capacity of AI to lead humans towards a better future, through supporting reasoning.
- **Technological progress as the way to societal progress**. In some techno-optimist narratives, technological social progress is conceived primarily as a by-product of economic growth, inherently driven by technological advancement, rather than a distinct objective requiring independent consideration. This perspective assumes that societal value naturally follows technological advancements, overlooking the need for independent consideration of social challenges and their solutions beyond technology alone.

> *"Science and Technology Studies (STS) calls for critical reflection on such assumptions, questioning paths that may seem inevitable and revealing them as products of specific cultural and historical contexts. The visions we habitually take for granted must be understood as just one amongst other possible or desirable visions. For example, the Digital Humanism Initiative emphasize reclaiming control over technology development, challenging the idea that innovation inherently leads to progress. Two key narratives are questioned: the belief that digitization is universally beneficial and the assumption that market-driven technological advancement naturally leads to better futures."*

4. USE CASES: A SENSITIVE STEP FOR THE INTEGRATION OF VALUES

The transition from a technology's general capability to the specific design of a use case has a direct and creative impact on shaping our future society. When developing sector-specific applications, we make choices about the goals to pursue, the approaches to take, the functions to enable, the appliances to create, and the tools and resources to use.

These choices are not neutral; they are driven by our priorities, which stem from our value system and are often shaped by implicit assumptions. The values prioritized by individuals or organizations will determine one vision of the future over another, and reinforce certain values over others. The outcomes—both in terms of concrete innovations and practical applications—will differ significantly, depending on these underlying choices.

A critical and reflective assessment of the criteria, priorities, and assumptions guiding technological development reveals that the paths we pursue are inherently relative, shaped by the vision of the future of small segments of society. Examining different stakeholder groups uncovers diverse combinations of values, priorities, and interests—many of which may be only partially represented in dominant innovation visions and narratives. This disparity directly impacts acceptance dynamics, shaping how technology is received and integrated.

> *"Transport. A system designed to reduce individual car use in favor of shared mobility or cycling promotes a vision of urban living centered around sustainability, community interaction, and reduced environmental impact. Conversely, prioritizing the expansion of private vehicle infrastructure reinforces a different model—one that values individual convenience, personal freedom, and market-driven automotive growth, often at the cost of congestion and pollution.*
>
> *Agriculture and farming. Policies that favor sustainable and organic practices align with values of environmental responsibility, biodiversity, and animal welfare, whereas optimizing for sheer productivity upholds economic efficiency and food security as primary concerns, sometimes at the expense of ecological balance.*
>
> *Entertainment, cultural, and creative sectors. Decisions on what content to promote—whether fostering diverse, independent storytelling or prioritizing mass-market commercial productions—shape societal narratives, shared values, and collective identities."*

In the case of 6G, what underlying value systems are driving its development and objectives? Which problems are prioritized, which applications are pursued, and how are these decisions made? Ultimately, whose vision of the future is being nourished and actualised? Society is varied, and there are several ways to see how the future should look like.

Describing a use-case with a different perspective; taking into account societal broader and longer-term objectives; outlining visions of the future based on priorities and goals of a larger portion of society; adapting our vision to evolving societal needs: these are only few examples of how a widening of perspective could impact the development and innovation process.

> *"It is unlikely that a new digital world can embrace precisely the same values and established principles that have governed our non-digital history. At the same time, this cannot mean to throw all established principles and learnings overboard. The difficult question then is which values to keep core and where to embrace new or adapted principles." Erich Prem, Principles of digital humanism: A critical post-humanist view."*
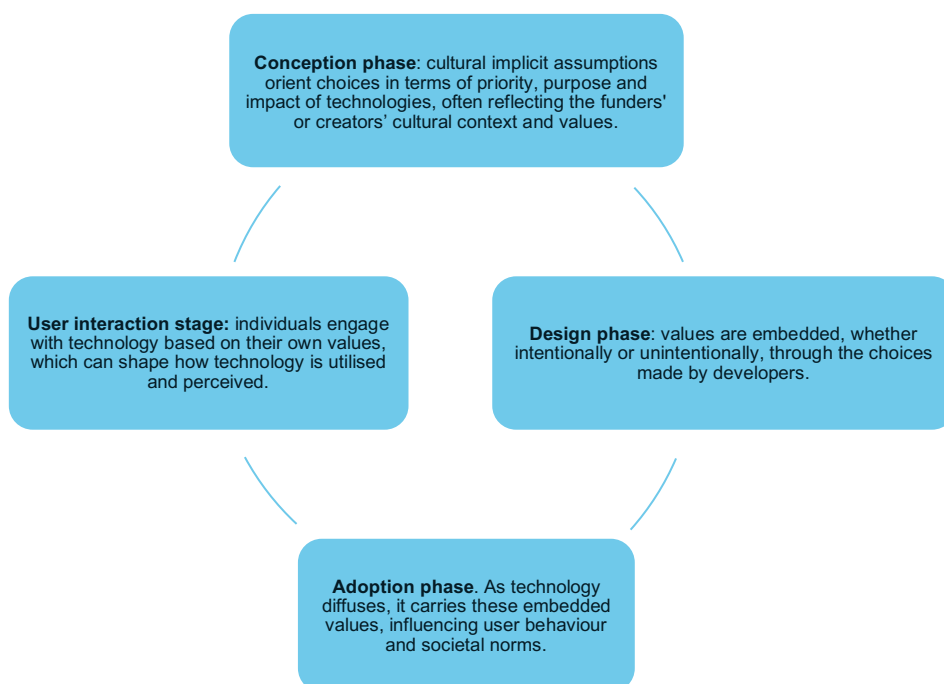
TECHNOLOGY TRANSFORMS SOCIETAL VALUES

Technology transforms the values of the societies that adopt it. While values shape technology development and functionalities, these technologies simultaneously reshape social values. When development teams prioritize certain features of 6G, they are not just making technical choices; they are transferring and reinforcing assumptions about what matters most in society. This interaction positions technology as both a political and moral actor. By adopting or regulating technology, societies embed values that reshape societal norms, expectations, and individuals' behaviors. This transformation extends beyond personal actions to affect mental models, relationships dynamics, power structures, and ultimately policies, practices, and resource allocation.

"Let's consider a speed bump; beyond its physical function, it also forces those around it to act in specific ways and is imbued with the value of safety and caution. It forces cars to slow down, allows pedestrians to cross with little fear, helps keep children playing in the street safe, and ultimately communicates the norm that human safety is more important than faster commutes. Any technology, as human artefact, is no different: it encourages humans to act in specific ways, transferring rules about what is appropriate behaviour and what is an acceptable outcome."

The advent of hyperconnectivity has already produced substantial shifts in societal values. The ease of accessing vast amounts of digital content, combined with interaction patterns shaped by social media platforms, has fundamentally altered communication norms. 6G will likely intensify these changes, redefining work and human interactions in profound ways.

"The online space of social media also contributed to change our perception of time and personal space and influenced how people invest time in relationships. Social media changed the perception of what is allowed to be shared in public, affecting what it means to ensure privacy, equity and accountability. Also, they weakened the sense of perceived hierarchy, spreading a sense of closeness and of easier approachability. Finally, the increasing fragmentation of the information sphere, caused by information tailoring to individual preferences, raises challenges as concerns community cohesion."

Conception phase: cultural implicit assumptions orient choices in terms of priority, purpose and impact of technologies, often reflecting the funders' or creators' cultural context and values.

User interaction stage: individuals engage with technology based on their own values, which can shape how technology is utilised and perceived.

Design phase: values are embedded, whether intentionally or unintentionally, through the choices made by developers.

Adoption phase. As technology diffuses, it carries these embedded values, influencing user behaviour and societal norms.

VALUES IN TECHNOLOGY: FROM THEORY TO PRACTICE

This document has explored the relationship between technologies and values, highlighting the non-neutral nature of technology and the necessity for greater awareness of the complex, bidirectional interplay between them. Better understanding of these mechanisms is crucial to minimize biases and enable more intentional and effective steering of technological development toward broader societal impacts.

This process presents significant challenges. It requires acknowledging the plurality of value systems and priorities in society, which calls for more inclusive governance and design mechanisms capable of managing diversity and divergences. Engaging values in technological development necessitates reshaping conceptual frameworks traditionally built on technology-driven and performance-oriented criteria. This shift would expand our understanding of technology's profound role in transforming society. From the initial conception phase of technology, different questions and assumptions should guide goals and daily work, establishing new approaches at various development stages and decision points.

Key Value Indicators represent a promising approach to address these challenges. Simultaneously, reflections on social acceptance dynamics help reveal the variety and plurality of value systems across society, including controversies surrounding science and technology. The next issue in this Insight Report series will explore these topics in greater detail.